MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. XXIII. *February* 13, 1863. No. 4.

THE Annual General Meeting of the Society, Dr. LEE, President, in the Chair.

Rev. Samuel F. Cresswell, Durham;
Major M. Foster Ward, Castle House, Calne, Wilts;
James L. Shuter, Esq., 33 Farringdon Street; and
William Esson, Esq., Merton College, Oxford,

were balloted for and duly elected Fellows of the Society.

Report of the Council to the Forty-third Annual General Meeting of the Society.

The Report of the Auditors, subjoined, will show the state of the finances:—

RECEIPTS.

	£	s.	d.
Balance of last year's account	171	9	1
By dividend on £2100 Consols	30	6	5
By ditto on £3850 New 3 per Cents	55	11	9
By ditto on £2100 Consols	30	6	5
By ditto on £3850 New 3 per Cents	55	11	9
On account of arrears of contributions	84	0	0
129 contributions (1862–63)	270	18	0
3 compositions	63	0	0
Carried forward	£761	3	5

	£	s.	d.
Brought forward	761	3	5
29 admission-fees	60	18	0
26 first year's contributions	44	2	0
2 contributions for 1864 and 1865	4	4	0
Sale of Publications	169	14	10
By interest on money for India Hill Observatory	29	16	5
	£1069	18	8

EXPENDITURE.

	£	s.	d.	£	s.	d.
Salaries:—						
Mr. Cayley, 1 year as Editor of the Society's Publications	60	0	0			
Mr. Williams, 1 year as Assistant-Secretary	100	0	0			
Ditto commission on collecting £631 14*s.* 10*d.*	29	5	0			
				189	5	0
Investments:—						
Purchase of £50 New 3 per Cents	46	9	0			
Ditto £50 New 3 per Cents	46	1	3			
				92	10	3
Taxes:—						
Income Tax, 1 year	1	17	6			
Ditto on E. I. Coupon	0	7	6			
Assessed and Land, 1 year	4	9	2			
				6	14	2
Bills:—						
Strangeways and Co., printers	243	12	0			
J. Rumfitt, bookbinder	36	5	3			
J. Basire, engraver	58	16	0			
Maltby and Sons, lithographers	37	18	10			
Williams and Norgate, printing	9	2	0			
Deville, gasfitter	4	12	6			
Insurance (Sun Fire Office)	12	5	6			
				402	12	1
Miscellaneous items:—						
Charges on books, and carriage of parcels	3	13	8			
Postage of *Monthly Notices*, letters, &c.	35	11	9			
Porter's and charwoman's work	24	1	3			
Tea, sugar, biscuits, &c. for evening meetings	13	13	0			
Waiters attending meetings	3	17	0			
Coals, &c.	12	0	0			
Sundry disbursements by the Treasurer	31	4	6			
Sundry payments out of Turnor Fund	5	13	0			
Deduction on country cheque	0	1	0			
Mrs. Jackson's annuity, 1 year	8	13	4			
				138	8	6
Balance at Banker's				240	8	8
				£1069	18	8

Assets and present property of the Society, Feb. 9, 1863:—

				£	s.	d.
Balance at Banker's				240	8	8
4	contribution of	5 years'	standing	42	0	0
9	——— of	3	ditto	56	14	0
23	——— of	2	ditto	96	12	0
64	——— of	1	ditto	134	8	0
				329	14	0
Due for publications of the Society				2	1	8

£3850 New 3 per Cents. including Mrs. Jackson's gift (£300).
£2100 Consols, including the Lee Fund, (£100), and the Turnor Fund (£500).
Unsold publications of the Society.
Various astronomical instruments, books, prints, &c.
Balance of Turnor Fund (included in Treasurer's account) ... 69 16 10

Stock of volumes of the *Memoirs*:—

Vol.	Total.	Vol.	Total.	Vol.	Total.
I. Part 1	21	X.	194	XXI. Part 2 (separate).	100
I. Part 2	63	XI.	204	XXI. (together).	124
II. Part 1	80	XII.	206		
II. Part 2	44	XIII.	227	XXII.	202
III. Part 1	98	XIV.	324	XXIII.	203
III. Part 2	119	XV.	193	XXIV.	210
IV. Part 1	120	XVI.	196	XXV.	219
IV. Part 2	131	XVII.	194	XXVI.	228
V.	147	XVIII.	193	XXVII.	483
VI.	168	XIX.	207	XXVIII.	449
VII.	191	XX.	200	XXIX.	482
VIII.	177	XXI. Part 1 (separate).	316	XXX.	262
IX.	181				

Progress and present state of the Society:—

	Compounders.	Annual Contributors.	Non-residents.	Patroness, and Honorary.	Total Fellows.	Associates.	Grand Total.
February 1862 ...	164	232	31	4	431	49	480
Since elected	3	21	...	1	...	1	...
Deceased	—4	—3	...	...	...	—3	...
Resigned	...	—3	...	...	...	...	...
Removed for non-payment	...	—2	...	...	...	...	...
February 1863 ...	163	245	31	5	444	47	491

The instruments belonging to the Society are as follows:—

The *Harrison* clock,
The *Owen* portable circle,
The *Beaufoy* circle,
The *Beaufoy* transit,
The *Herschelian* 7-foot telescope,
The *Greig* universal instrument,
The *Smeaton* equatoreal,
The *Cavendish* apparatus,
The 7-foot Gregorian telescope (late Mr. Shearman's),
The Variation transit (late Mr. Shearman's),
The Universal quadrant by Abraham Sharp,
The *Fuller* theodolite,
The Standard scale,
The *Beaufoy* clock,
The *Wollaston* telescope,
The *Lee* circle,
The *Sharpe* reflecting circle.

The *Sheepshanks'* collection of instruments, viz.,—

1. 30-inch transit, by Simms, with level and two iron stands.

2. 6-inch transit theodolite, with circles divided on silver; reading microscopes, both for altitude and azimuth; cross and siding levels; magnetic needle; plumbline; portable clamping foot and tripod stand.

3. 4-$\frac{6}{10}$ achromatic telescope, about 5 feet 6 inches focal length; finder, rack motion; double-image micrometer; object-glass micrometer; two other micrometers; one terrestrial and ten astronomical eyepieces, applied by means of two adapters.

4. 3$\frac{1}{4}$-inch achromatic telescope, with equatoreal stand; double-image micrometer; one terrestrial and three astronomical eyepieces.

5. 2$\frac{1}{4}$-inch achromatic telescope, with stand; one terrestrial and three astronomical eyepieces.

6. 2$\frac{3}{4}$ achromatic telescope, about 30 inches focus; one terrestrial and four astronomical eyepieces.

7. 2-foot navy telescope.

8. 45-inch transit instrument, with iron stand, and also Y's for fixing to stone piers; two axis levels.

9. Repeating theodolite, by Ertel, with folding tripod stand.

10. 8-inch pillar-sextant, divided on platinum, with counterpoise stand and horizon roof.

11. Portable zenith instrument, with detached micrometer and eyepiece.

12. 18-inch Borda's repeating circle, by Troughton.

13. 8-inch vertical repeating circle, with diagonal telescope, by Troughton and Simms.

14. A set of surveying instruments, consisting of a 12-inch theodolite for horizontal angles only, with extra pair of parallel plates; tripod staff; in which the telescope tube is packed, repeating table; level collimator, with micrometer eyepiece; and Troughton's levelling staff.

15. Level collimator, plain diaphragm.

16. 10-inch reflecting circle, by Troughton, with counterpoise stand; artificial horizon, with metallic roof; two tripod stands, one with table for artificial horizon.

17. Hassler's reflecting circle, by Troughton, with counterpoise stand.

18. 6-inch reflecting circle, by Troughton, with two counterpoise stands, one with artificial horizon.

19. 5-inch reflecting circle, by Lenoir.

20. Reflecting circle, by Jecker, of Paris.

21. Box sextant and 3-inch plane artificial horizon.

22. Prismatic compass.

23. Mountain barometer.

24. Prismatic compass.

25. 5-inch compass.

26. Dipping needle.

27. Intensity needle.

28. Ditto ditto.

29. Box of magnetic apparatus.

30. Hassler's reflecting circle, with artificial horizon roof.

31. Box sextant and $2\frac{1}{4}$-inch glass plane artificial horizon.

32. Plane speculum artificial horizon and stand.

33. $2\frac{1}{2}$-inch circular level horizon, by Dollond.

34. Artificial horizon roof and trough.

35. Set of drawing instruments, consisting of 6-inch circular protractor; common ditto; 2-foot plotting scale; two beam compasses and small T square.

36. A pentagraph.

37. A noddy.

38. A small Galilean telescope, with the object lens of rock-crystal.

39. Six levels, various.

40. 18-inch celestial globe.

41. Varley stand for telescope.

42. Thermometer.

43. Telescope, with the object-glass of rock crystal.

These are now in the apartments of the Society, with the exception of the following, which are lent, during the pleasure of the Council, to the several parties under mentioned, viz.:—

The *Wollaston* telescope, to Mr. Rees.
The *Lee* circle, to Mr. Burr.
The *Beaufoy* clock, to Dr. Booth.
The *Beaufoy* transit, to the Observatory, Kingston, Canada.

The *Sheepshanks* instrument, No. 1, to Mr. Lassell.
Ditto ditto No. 2, to Mr. De La Rue.
Ditto ditto No. 3, to Rev. C. Pritchard.
Ditto ditto No. 4, to Rev. F. Howlett.
Ditto ditto No. 5, to Mr. Birt.
Ditto ditto No. 6, to Rev. J. Cape.
Ditto ditto No. 8, to Prof. Wheatstone.
Ditto ditto No. 9, to Mr. Lockyer.
Ditto ditto No. 19, to Mr. Dayman.
Ditto ditto No. 25, to Mr. Dayman.
Ditto ditto No. 41, to Rev. C. Pritchard.
Ditto ditto No. 43, to Mr. Huggins.
The 6-inch circular protractor, to Mr. Birt.

Nothing definite has yet been ascertained respecting the other *Beaufoy* clock, the two invariable pendulums, and the quadrant (said to have been *Lacaille's*), reported for many years past as being in the possession of the Royal Society.

In consequence of a letter addressed by the Council to Lord Palmerston, Her Majesty's Government, in August 1861, granted the Society 1000*l.* in aid of the proposed temporary maintenance of an Observatory near Poonah, under the superintendence of the late Capt. Jacob. Upon that gentleman's departure for India, in the early part of last year, the sum of 500*l.* of this grant was advanced to him for his necessary expenses. Upon the Council receiving the information of the lamented death of Capt. Jacob, they directed application to be made to Lord Palmerston, for instructions as to the disposal of the balance remaining in their hands, amounting to 500*l.* In answer the Treasurer was requested to repay it to the Treasury, which has been done accordingly.

The Council have awarded the Gold Medal to Prof. Argelander, for his Survey of the Northern Heavens. The President will, in the usual way, explain the grounds of this award.

Printed Transactions of the Society.

The thirty-first volume of *Memoirs* is now published, and contains nine papers. Four of them are communications from Sir Thomas Maclear, referring to Comets which have been observed by him at the Cape of Good Hope, between the years 1853 and 1861. The fifth is by Mr. Cayley, and relates to the Problem of Disturbed Elliptic Motion, the object of the Memoir being to obtain the differential equations for the radius vector, longitude and latitude of the disturbed body, when the last-mentioned two co-ordinates are referred to an arbitrarily varying plane and departure point or origin of longitudes therein.

This is followed by three short papers by Colonel Strange, on certain interesting points connected with the adjustments and construction of Altazimuth Instruments and large Theodolites. These latter investigations may probably be opportune with reference to a considerable number of unusually large theodolites which are now in process of construction for the Great Indian Survey. The volume concludes with a Memoir, entitled "The Results of Planetary and Lunar Observations made at the Madras Observatory between the years 1831 and 1852." The reductions are made by Mr. Breen, after the manner and with the constants adopted at the Royal Observatory at Greenwich. Independently of its intrinsic value, this paper possesses an additional, though melancholy, interest, as associated with the death of Captain Jacob, under whose superintendence many of the observations were made.

Obituary.

The Society has to regret the loss by death of Prof. Barlow; Dr. Fisher; Thos. Gibbes, Esq.; Capt. Jacob; John Riddle, Esq.; Sir J. C. Ross; J. Walton, Esq., Fellows of the Society; and also of M. Carlini; Professor O. M. Mitchell; M. C. Rümker, Associates. The death of M. Biot, Associate of the Society, was announced in the last Annual Report, but the biographical notice was deferred till the present year.

Peter Barlow, Esq., F.R.S., Member of the Imperial Academy of St. Petersburgh, and of the Royal Academies of Brussels, Utrecht, &c. &c., was born in the parish of St. Simon, Norwich, in Oct. 1776, and died March 1st, 1862, in the eighty-sixth year of his age. In 1801 he was appointed one of the Mathematical Masters of the Royal Military Academy, Woolwich. In 1811 he published his first work, *On the Theory of Numbers;* in 1814, his *Mathematical Dictionary;* and in the same year, his "Mathematical Tables." Up to this time Mr. Barlow's pursuits had reference to abstract science. In 1815 he commenced his first attempt at the application thereof to physical science, founded on experiments on the strength of wood, iron, and other materials. This formed the basis of his work, *On the Strength of Materials*, published in 1817, which, being well received by the architects and civil engineers of the metropolis, led to an intimate acquaintance with the leading professors of those arts. It was also about this time that Mr. Barlow began his connexion with the *Encyclopædia Metropolitana*, to which he largely contributed. About 1819 his mind was turned to the pursuit of magnetic experiments, in which he was very successful, as well in developing the laws of the action of magnetism as in the application of those laws to the correction of a long-standing error in Navigation. These formed the subject of his *Essay on Magnetic Attraction*, pub-

lished in 1819. For this discovery he received several honorary and pecuniary rewards. In 1821 he received the Gold Medal of the Society for the Encouragement of Arts. In 1824, on the adoption of his corrections in the Russian Navy, his services were handsomely acknowledged by the Emperor Alexander. In 1825 he received the Copley Medal of the Royal Society, with pecuniary presents from all the principal Naval Boards.

The subject which had covered him with these honours, and which engaged much of his attention for seven years, having been fully established in the British Navy, as well as in the navies of several foreign powers, and no longer requiring his attention, he turned to optical experiments. In 1827 he suggested a new form of Refracting Telescope, of which he constructed two, and laid them before the Board of Longitude, with a proposition for constructing a large national telescope, which obtained the approbation of that Board. The great difficulty of procuring flint glass for achromatic telescopes seems to have been the principal motive for attempting this novel construction, the basis of which was an object-lens of fluid cased in glass.

Mr. Barlow was a sound mathematician, and was acquainted with the foreign writers at a time when this could not be said of many. He showed this acquaintance in his work on the Theory of Numbers—a subject on which he has, as yet, no English successor. His Tables—which give the squares, cubes, square and cube roots, reciprocals and factors, of all numbers up to 10,000—would have been exceedingly useful to all engaged in practice if the disposition had existed to believe in anything beyond a table of logarithms. As it happened, the use of them was confined to but a few of those whom they might have benefited. The late Mr. Henderson, for instance, who discovered for himself that Crelle's multiplication-table up to 1000 × 1000 is, for many purposes, a far more powerful instrument than the table of logarithms, was a constant user of Barlow's Tables. The work, now out of print, contains many subsidiary matters of use and interest. What is described above, the factors excepted, was republished in stereotype, under the sanction of the Useful Knowledge Society and the superintendence of Mr. Farley, in 1840.

For many years before his death Mr. Barlow had completely relinquished active exertion. Whether we look at his public or his private life, the Society may be proud of his name, which, owing to his great age and long retirement, belongs to a former day.

Capt. William Stephen Jacob, son of the Rev. S. L. Jacob, was born at Woolavington, in Somersetshire, Nov. 19th, 1813. He was chiefly educated at home, until he went as a Cadet to the Hon. East India Company's College at Addiscombe, in the

beginning of the year 1828, being then fourteen years old. Having passed for the Engineers in less than the time allowed for that course of study, he went, according to the regulations then in force, to Chatham, where his aptness as a mathematician still further developed itself. In 1831 he sailed for India, and not long after his arrival at Bombay he was appointed to assist General, then Lieut., Shortrede, who was engaged in the Survey of North-Western India, and in this occupation he was employed for several years.

During his stay in India, Capt. Jacob was not only assiduous in all his professional duties, but found time for his favourite study of astronomy, as evinced by the measures which he made of double stars at Poonah, with his own instruments in his own private observatory.

He came to England on furlough in 1843, and having married during his stay there, he returned to India again in 1845. A few years afterwards he resigned the Company's service, but he continued to reside in India, devoting himself to scientific pursuits, until he was appointed to the post of Astronomer at Madras, without application on his part, but from his several papers transmitted to this Society, and printed in their *Memoirs*. How admirably he discharged his duties there, as a careful and accurate observer, and able computer, is well known to us all, by the orbits which he deduced from his own observations of some binary stars, by his measures of *Saturn* and his satellites, and by his rigorous scrutiny of the mass of *Jupiter*. He found the climate of Madras, however, unsuitable to his health, and after having twice been obliged to return to England on sick certificate, he felt it his duty at last to resign the appointment. In the end of April last year Capt. Jacob, having purchased a telescope of nine inches aperture, returned to India under the auspices of the Astronomical Society, for the purpose of establishing an Observatory on the Mahratta hills. He landed at Bombay on August 8th, and started off for his former place of residence, Poonah; but, having been seized with a violent liver attack, expired there on the 16th of that month, in the 49th year of his age, leaving a widow and eight children.

Capt. Jacob was a man of deep religious feelings, and an earnest Christian. He seemed capable of mastering any subject to which he turned his attention, though mathematical science attracted him the most. His memory was singularly retentive, so that from his extensive reading his mind was remarkably stored with both ancient and modern lore.

Mr. John Riddle was born at Newcastle-upon-Tyne in November 1816, and was the only son of one of the earliest and most respected Fellows of our Society, the late Mr. Edward Riddle.

At the early age of fifteen Mr. J. Riddle was appointed an

Assistant Master in the Greenwich Hospital Schools, and on the retirement of his father in 1851 was chosen to succeed him as Head Master.

In the year 1846 he was elected a Fellow of this Society, and from that time till his death was a regular attendant at its meetings, and an occasional contributor to its papers.

He was appointed, in the year 1854, Examiner in Navigation to the Science and Art Department of the Committee of Council on Education, and held for many years a similar appointment in the Society of Arts. By both these Institutions his services were highly valued.

As a teacher Mr. John Riddle was perhaps unrivalled, and his success in instilling into the minds of mere boys not only the practice but also the theory of Navigation was very remarkable. The influence he possessed with his pupils was unbounded; and the good which he has accomplished by stamping on a vast number of the scientific officers of the Royal Navy the impress of his own vigorous mind so great, that his untimely death can be looked upon in no other light than a national loss.

Mr. Riddle was not only a good mathematician and a successful teacher, but also an accomplished gentleman, with a great taste for poetry and the arts. In society he was a universal favourite, and his urbane manners and intellectual conversation will long be remembered by a large circle of sorrowing friends.

His death was the result of an accident — a fall from a platform in his class-room, which produced concussion of the brain, from which, after lingering sixteen days, he expired on the 11th of October last.

Mr. John Walton was one of the members of the Mathematical Society, and became a Fellow of this Society when, in 1845, the two were amalgamated. He was for many years in business as a sugar-refiner, from which he retired in 1832 with a competency. He joined the Mathematical Society in 1806, and was much respected by the members. He was also a Fellow of the Linnean and Entomological Societies, to whose Transactions he contributed numerous valuable papers. He died at Knaresborough on the 3d of January, 1863, aged 78.

Jean-Baptiste Biot (born April 21, 1774, died Feb. 3, 1862) is the last of the great men of science who belonged to what he himself jocosely called the *first edition* of the French Revolution. To give any account of his labours on such an occasion as the present would be inadmissible: several of them are too well known, the others are too numerous. We shall therefore allude to but few of the 477 heads under which his writings have been enumerated by M. Lefort, the son of his

daughter's daughter, who declares himself certain that the list is far from complete.

The father of J. B. Biot, whose ancestors had been farmers in Lorraine, was himself in some office of the Treasury. The son, after studying at the Collège Louis-le-Grand, joined the army as a volunteer, and was present at the battle of Hondschoote, in 1793. He then retired from military life, and became a student in the Ecole des Ponts et Chaussées, and in the Polytechnic School. In 1797 he was named Professor of Mathematics at the Central School of the department of the Oise. He here introduced himself to notice by some mathematical papers, and became known to Laplace. In 1800 he was removed to Paris, as Professor of Mathematical Physics at the Collège de France, and Associate of the Institute. At his death he was a member of three of the four French Academies—a distinction which few, if any, ever gained before him. In 1806 he commenced, in concert with Arago, his continuation of the arc of the meridian. In 1808 he measured the length of the pendulum at Bordeaux. In 1817 he repeated this operation in Scotland and the Shetland Islands. In 1818 he was employed at Dunkirk, in concert with an English Commission, on the determination of the latitude. In 1824 and 1825 he was employed in Illyria, &c. on the measurement of the pendulum at different points of the mean parallel of latitude, and also at the extremity of the Spanish arc. These were the points in which a long life passed in physical investigation was most connected with astronomy. It is not necessary to speak in detail of the publications connected with the Great Survey. His work, entitled *Traité Elémentaire d'Astronomie Physique*, of which three editions were published (1805, 1810–11, 1841–57) was more than its name imports, being a mathematical system, in which the mathematical part is subordinated to a very extensive treatise on astronomy strictly physical: it is, in fact, what was left undone in the closely mathematical system of Délambre.

It is not our business to do more than refer to the extensive writings of Biot on optics and physics in general. All of middle age who were students of these subjects will remember that Biot was the originator of those encyclopædic works on experimental science which continue to appear from time to time. Four valuable volumes, the *Traité de Physique*, appeared in 1816; followed, in 1817, by the *Précis Elémentaire*, in two volumes. The reader of these volumes remembers how frequently Biot had to refer to his own experiments, and how completely he was made to feel that his instructor had travelled over all the ground, either by experiments of his own making, or actual and personal cognizance of those made by others. In these, as in all his other publications, there is continual evidence of the presence of the mathematician who has all the powers of geometry in reserve, but is prevented,

both by a natural turn for the experimental and by the matured habits of an old teacher, from introducing more than will just serve the purpose.

Biot must be numbered among the historians of science. Not that he ever wrote a work professedly on history, but because his writings on historical points form a large mass, involving much research and much valuable criticism. On the ancient Egyptian and Oriental astronomy he was engaged during most years of the second half of his life. In particular we may refer to his "Recherches sur l'Année vague des Egyptiens," read before the Academy of Sciences, 1831, where he shows, from the hieroglyphics in the Rhamesseum, at Thebes, that the point of the vernal Equinox was in the constellation *Taurus* during the reign of Rhameses III. He was editor of the *Journal des Savans* in 1816, and remained a contributor to the end of his life. He wrote in it, or in the *Moniteur Universel*, about 120 articles, many relating to the history of the past, and all of the critical cast. Thus we have, from 1816 to 1862, a succession of descriptive accounts, involving history or criticism from one mind. To this must be added twenty-three biographies in the *Biographie Universelle*, many of which are cited as separate works, and many short articles scattered elsewhere.

An account of the opinions of Biot, as involved in his accounts of others, would lead to discussions involving matters of controversy. The style in which he treats his subjects is eminently attractive. In his didactic writings he is diffuse, and his own peculiar spirit is undiscernible through his explanations. In his critical writings he has a strong and distinct character, marked by satire powerfully applied, but without ill-nature. In his private life he gained the respect of all. He was the Nestor of the Institute for many years. He was for three weeks the subject of Louis XV., and lived nearly ten years under Louis Napoleon. Of this long life, sixty-five years were passed in public posts.

Francisco Carlini, Director of the Royal Observatory of Milan, died at Milan on the 29th of August, 1862, in his seventy-seventh year.

He commenced his astronomical career at an early period, by the calculation of the *Milan Ephemeris* for the year 1804, and his highly useful labours extended over two-thirds of a century. During the whole of this period he prosecuted his studies for the advancement of science with unceasing assiduity.

He continued his calculations and writings in the *Milan Ephemeris* until his last illness, and only four weeks before his death he completed his calculations of the Elements of the second Comet of 1862.

Carlini's writings and his exertions for the advancement of

learning and science are familiar to all astronomers. He was conversant with foreign languages and literature, and spent much time on works of mechanism. His deportment was pleasing and agreeable, and his moral character blameless.

Of our late valued Associate, Professor Ormsby Macnight Mitchel, it may be said the account of his life resembles a romance rather than a biography. He was one of those many salient instances of unconventional humanity who present themselves in a new country for the instruction, if not for the imitation, of their contemporaries. America may be justly proud both of the intellectual powers and the versatility of a man who, in early manhood, was a Soldier, then a Professor of Mathematics, then a Lawyer, then an Astronomer, then a Railway Engineer, and finally as a Major-General, ended his life, as he began it, in the Army.

Professor Mitchel was born on the 28th of August, 1810, in Union County, Kentucky. At an early age he gave promise of the ability and eminence which his future so fully realised. He was appointed a Cadet in the U. S. Military Academy in 1825. He graduated with distinction in 1829, and was very soon appointed Assistant Professor of Mathematics, which post he held for two years. He subsequently resigned his commission in the Army, and, after practising Law for a short time, he accepted the chair of Mathematics and Astronomy in the Cincinnati College, Ohio, in which position he continued for ten years.

It was here that he commenced a series of lectures; and those which he delivered on the physical constitution and telescopic appearances of the planets created so vast an enthusiasm, that it was resolved to furnish the city with a large telescope forthwith. Subscriptions for this purpose poured in from all quarters; and as specie was not always at hand, there were not a few contributions in kind, such as hats and caps, and other unastronomical apparatus. Mitchel then proceeded to England in quest of his telescope, and was there introduced to the Astronomer Royal by John Quincy Adams. At his earnest request, Mr. Airy allowed him to go through the greater part of the Greenwich course; and for some time he worked as a computer at one of the Royal Observatory desks. On his return home, the population of Cincinnati assembled, in the largest church of the place, to hear the account of his mission. The first-fruits of Mitchel's labours with his large equatoreal was the discovery of the companion of *Antares*. But, inasmuch as a rival telescope at another place, owing to an idiosyncracy of its object-glass, showed two companions instead of one, the ill-fated Astronomer and his Observatory were shorn of their glory and their subscriptions besides. After this, the Professor was concerned as Projector, Director, and Engineer, in "building" certain Railways; and it is hoped

he realised a good fortune thereby. He was in England a second time for the sale of railway bonds.

During his career as an Astronomer he was certainly one among the first who in any way applied galvanic electricity to astronomical observations; but this remark is not intended to apply to the principle of the *chronographic* record.

In the course of the unhappy struggle now, alas! consuming the resources and the population of a magnificent country, Mitchel returned to the Army, and, at the age of fifty-two, after a brief illness of four days, died of fever at Beaufort, being at that time a Major-General and Commander of the Federal Army in South Carolina.

Proceedings at Various Observatories.

Royal Observatory, Greenwich.

In the ordinary operations of the Royal Observatory, Greenwich, no changes of importance have been introduced during the past year; the observations have been of the usual character, and the reductions have not been allowed to fall behind.

The Star Observations from 1854 to 1860 are being incorporated into a Catalogue: this will contain about 2020 stars; star constants, precessions, and secular variations have been recomputed for all the stars. The work is now far advanced and will shortly be ready for the press.

The difference in longitude between the Royal Observatory, Greenwich, and Knightstown, Island of Valentia, has been redetermined. The very unfavourable weather of the past season protracted this operation much beyond the expected limits, and it has pressed heavily on the Observatory; the result obtained is, however, satisfactory; it agrees almost identically with the chronometrical determination of 1844. Advantage has been taken of the favourable circumstances connected with the late opposition of *Mars;* differences in Right Ascension between *Mars*, and stars east and west of the meridian, have been obtained with the Great Equatoreal. These observations are now under reduction, and it is hoped that the result may be laid before the Society at its next Meeting. *Mars* has been well observed on the meridian for combination with the Declination observations of the Southern Observatories. The method for determining the motion of the Solar System in space, proposed by the Astronomer Royal in 1859, has been applied to 1167 stars. The reductions are completed, and the results will shortly be laid before the Society.

The apparatus arranged by the Astronomer Royal for observing the fixed lines of Star spectra, and referring them to the fixed lines of the Sun spectrum, has been completed; the

arrangement is quite successful: pressure of other work has, however, prevented any systematic employment of this apparatus up to the present time.

Royal Observatory, Edinburgh.

From the Royal Observatory, Edinburgh, we hear of the usual round of official duties performed. The first and most prominent of these consists of the double system of time-signals, the visible and the audible, which are kept up daily from the two chief hills of the city, under the electric control of the Observatory and the interested surveillance of the citizens, but with a decided bias in favour of the "gun" over the "ball." Both methods have, however, at the present moment received a sudden check from the indirect effects of a most anomalous storm of lightning, which broke over the city with almost a hurricane of west wind and sleet on the 4th of February, at 7 P.M. The lightning, which is described as vividly blue and green, was seen to dart more horizontally than vertically, and at last set fire to the lower part of Nelson's Monument, an important intermediary in supporting the Observatory electric wires to both the time-ball and time-gun. The striking of a tall building so low down as in this case, or one-seventh from the bottom, is evidently noteworthy, together with the intensity of the discharge, which pierced holes of three quarters of an inch in diameter through a leaden roof, streaming at the time with conducting water, and furnished with metal pipes; but the most immediately important matter in regard to the time-signals has proved to be, that every member of one whole bundle of so-called "permanent" magnets in the controlled clock at the Castle has had its poles changed; and some similar bars in a clock at the Observatory has had two or three pairs of poles put into them.

Another, and a more considerable employment of the time and labour of the Observatory, is that required for the reduction of the meteorological observations taken by observers of the Meteorological Society of Scotland at fifty-five different stations in the country; and furnished, partly every month and partly every quarter, to the Registrar-General of Births, Deaths, and Marriages, in whose returns they are duly printed.

The Board of Visitors of the Observatory having desired that the original observations of the Teneriffe experiment should appear,—the printed volume of the *Edinburgh Astronomical Observations* has been detained for the insertion of a Teneriffe Appendix, which is now reported complete within a page or two. The same Board has also made some attempts during the past year to free the position of the Edinburgh Astronomer from the very untoward anomaly of being a public office without any salary attached to it, the actual condition in

which recent reforms at the College have left that of the Astronomers-Royal of Scotland. But up to the present time the Board has not succeeded in making any advance either in this point, or in that which they took up last year, viz., securing for the Astronomer a residence in or near the Observatory, instead of at the impracticable distance where it is now found.

Royal Observatory, Cape of Good Hope.

True to the chief object of its foundation, the Royal Observatory at the Cape of Good Hope has been occupied during the past summer by the parallax observations on *Mars*. These would have been made without doubt, whether any particular series of corresponding ones in Europe had been announced or not; and, in fact, they were made even in face of the statement contained in our *Monthly Notice* of May, which arrived at the Cape on the 15th of July, to the effect that the series of *Mars*-opposition observations prepared by a great Northern Observatory, would only be attempted if a promise of co-operation from a Southern Observatory should arrive on or before the 20th of August; and Sir Thomas Maclear knew only too well, that, though he answered by return mail, his letter could not reach Europe sooner than the 30th or 31st of August.

The Cape observations, nevertheless, began punctually on the 20th, and were continued on from that date through the whole opposition period, up to November 3d, weather permitting, with the result of measures being obtained on 45 nights out of 75. These measures were taken on the meridian with the fine transit circle of iron; others had been attempted on Mr. Airy's suggestion for the parallax in Right Ascension, with the equatoreal; but these were completely defeated by the badness of atmospheric definition when the planet was at a very low altitude, for there was nothing indicative of a "limb" to be seen about it. "I exceedingly regret the failure," writes Sir T. Maclear; "partly because the method was recommended by Mr. Airy, and partly because the advantage of the method is undeniable if a clear sky and good definition could be commanded at low altitudes. Unfortunately, atmospheric phenomena decline to be at the beck and call of practical astronomy." A most true remark, we may observe, unless the subject be treated in the manner adopted by Mahomet and the mountain; and by precisely the same act, too, viz., going to a mountain, and ascending there so high, that both observer and telescope shall find themselves in what Sir Isaac Newton describes as the serene and quiet (and necessarily rarified) air, above the grosser clouds, and which as he long ago assured astronomers is "the only remedy by which that *confusion of rays which arises from the tremours of the atmosphere*," can ever be removed from large telescopes.

The Radcliffe Observatory, Oxford.

No material change has occurred in the organisation of the Radcliffe Observatory, Oxford, since the publication of the last Annual Report of the Society. The staff of Assistants is precisely the same as at that time, and the subjects of observation have been those indicated in that Report,—namely, for Meridian observations, stars between the fifth and seventh magnitudes, and the Sun, the Moon, and the large planets, including a good series of observations of *Mars* near opposition. In addition, *Mars* has been well measured with the heliometer, and the results have been given to the Society in a Memoir by Mr. Main. *Saturn* has also been measured during the disappearance of the ring, and the resulting ellipticity agrees very closely with the former value deduced at Greenwich. The Great Comet of 1862 was observed on several evenings, and the results have been communicated to the Society. The number of double stars which have been observed with the heliometer now exceeds two hundred; but the past year has been singularly unfavourable to all classes of delicate observations.

The Carrington Transit-circle has been used throughout the year 1862 without interruption, and the results will, it is hoped, sustain the high character which it had while in the hands of Mr. Carrington.

The Photographic Meteorology has been kept up without intermission, and, in the hands of Mr. Lucas, the photographs are much better and the interruptions of continuity less than in former years.

The reductions of the observations are in a tolerably satisfactory state. The twentieth volume of the Radcliffe Series, containing the observations for 1859 and 1860, was published in July last, and the twenty-first volume is now being printed with great rapidity, the reductions of the astronomical observations for 1861 being nearly completed. The reductions of the observations for 1862 are also in progress.

Considering the smallness of the force employed, consisting of the Director, two Assistants, and one Computer, the amount of work which has been accomplished during the preceding year is highly satisfactory; and, without any further encroachment on the resources of the Trustees, a few years of such continuous labour must produce results of very great importance to astronomy.

The Cambridge Observatory.

The meridian observations made at this Observatory, under the direction of Prof. Adams, during the past year comprise, in addition to those of the fundamental stars, Observations of the Stars which were used for comparison with Comet II., 1861,

Observations of the Sun near the summer and winter Solstices and the autumnal Equinox, Observations of the planets *Jupiter* and *Neptune*, and Circle Observations of *Mars*, and of the stars selected by Dr. Winnecke to be compared with the Planet in Declination, with a view to the determination of its parallax.

The Equatoreal Observations comprise a series of observations of Comet II., 1862, and a series of comparisons in R.A. between *Mars* and neighbouring stars, taken on both sides of the meridian according to the plan described by the Astronomer Royal in the *Monthly Notices*, vol. xviii. p. 277. By this method the parallax of *Mars* may be determined by means of observations taken at a single Observatory. Charts drawn on a large scale were prepared of all the stars near the path of *Mars*, which are contained in Dr. Argelander's valuable Survey of the Northern Heavens, and the stars of comparison were selected from these. The weather was in general very unfavourable during the course of these observations, so that not many sets of corresponding evening and morning observations could be obtained.

Some new arrangements have been made in connexion with some of the instruments. The old lever counterpoises of the Transit Instrument were removed some years since by Professor Challis, and replaced by spring counterpoises, in order to allow the use of micrometer microscopes, adjusted for viewing dots placed on the ends of the pivots, so as to afford the means of eliminating any errors arising from the form of the pivots. The spring counterpoises, however, have been found to act in a very unsatisfactory manner, as the pressures which they exert are continually varying with changes of temperature. Prof. Adams has accordingly removed them and restored the lever counterpoises, introducing, however, such an alteration into their arrangement, that the apparatus for examining the forms of the pivots may now be used while the counterpoises are in action.

The pendulum of the Transit Clock, which was in an unsatisfactory state, has been put into good order by Mr. Frodsham.

In consequence of the varying length and weight of the declination rods of the Northumberland Equatoreal, corresponding to different North Polar Distances, it is impossible to balance the instrument by any system of permanent counterpoises. A series of adjustible weights has therefore been introduced, which may be very conveniently applied, and by means of which, for any given value of North Polar Distance, the instrument may be very nearly balanced in all positions. Since these weights have been in use, the performance of the driving clock has been far more satisfactory than it was before.

The Jones Equatoreal has been dismounted for the purpose of being examined. Several of the springs which relieve the pressure on the lower pivot were found to be broken, and

the microscopes were out of order. The instrument is now in the course of being put into working order by Mr. Simms.

The dome of this Equatoreal was only moved, with difficulty, by the united force of two persons, and thus the use of the instrument was rendered exceedingly inconvenient. This dome is supported on fifteen cast iron wheels, which run in channels, above and below, also of cast iron. These wheels were formerly in bearing along their whole breadth, which is considerable, and thus a large amount of sliding friction was called into play when the dome was moved. The wheels have now been turned so that the breadth of the bearing surface is very much reduced, and the result is that the dome can be easily moved by one person. Surrounding the dome is some ornamental work, supported by a rim of cast iron, which was formerly embedded in the stone wall. Of course the alternate expansion and contraction of the iron from heat and cold, split the stone-work, and thus allowed damp to be admitted into the wall; an arrangement is now made which permits the free expansion and contraction of the iron rim, and which also effectually secures the wall against damp.

Some progress has been made in the arrangement and classification of the detached Memoirs and Pamphlets belonging to the Library of the Observatory, with a view to their being bound up in volumes. Professor Challis is proceeding with the printing of Vol. XX. of the Observations, which will include the remainder of the Meridian Observations to the end of 1860.

Liverpool Observatory.

At the Liverpool Observatory, Mr. Hartnup has been recently engaged in discussing the sea-rates of nearly two thousand chronometers, for the purpose of ascertaining the average errors for voyages of different lengths. On comparing the rates at sea with the rates of the same chronometers obtained at the Observatory, the importance of attending to the thermal correction has manifested itself more strongly than ever; and, in addition to this, the rates are often found to increase or diminish with such regularity from one month to another, that a correction for this may also be very frequently applied with great advantage. Mr. Hartnup has, therefore, been induced to make considerable alterations in his method of testing and giving the rates of chronometers, with the view of ascertaining the value of these corrections more accurately, and of rendering the application of them more simple.

Glasgow Observatory.

At the Glasgow Observatory Professor Grant continues to employ the Meridian-circle in the observation of a selection of stars, chiefly below the fifth magnitude. Much of his time

during the past year has been occupied with proceedings having for their object to increase the instrumental efficiency of the establishment. The want of an instrument for making extra-meridional observations has been much felt, but this defect is in the course of being remedied by the erection of the equato-really-mounted refractor of nine inches aperture, which belonged to the late Sir William Keith Murray, of Ochtertyre, and has been recently purchased by the University. For this valuable accession to the resources of the Observatory, the University is indebted to a few gentlemen chiefly residing in Glasgow, who have most liberally supplied the funds, not only for the purchase of the instrument, but also for the building of a separate edifice for its reception. It is expected that the instrument will be in complete working order before the close of this month.

Mr. De La Rue's Observatory.

The Cranford Observatory during the past year has been devoted mainly to photographing the Sun's disk, by means of the Kew heliograph, which has been placed there for that purpose. Mr. De La Rue's assistant, Mr. Reynolds, has obtained during the period from Feb. 7th, 1862, to Feb. 7th, 1863, about 160 photographs, one at least having been taken on every day when the state of the weather permitted. Thus a series, as continuous as possible, and extending over a whole year, has been procured, and the pictures will hereafter be measured by means of the micrometer, and the resulting data carefully discussed.

Besides photographs of the Sun, several fine lunar photographs have been taken of phases not included among the negatives previously obtained; and experiments in enlarging some of the lunar photographs to the dimensions of Messrs. Beer and Mädler's map have resulted in the production of charts of great utility and beauty. Messrs. Smith, Beck, and Beck, contemplate publishing these large charts in their entirety, for the use of selenographers; and also portions of them, suitable for the special study of those who may wish to devote themselves to the delineation of the minuter details, with the aid of eye-observations.

By the combined efforts of amateurs it is to be expected that the surface of the Moon will, in this way, be depicted with an accuracy and minuteness hitherto unattainable.

It will be recollected that Professor Selwyn, of Ely, who also has been working with an instrument constructed on the model of the Kew heliograph, but of smaller dimensions, has procured sun-pictures, on two of which, namely, on those procured respectively on Aug. 4th and Oct. 1st, he observes a notch in the Sun's limb corresponding in position with certain large spots; while eye-observations revealed a streak of the Sun's limb exterior to the supposed gap. This streak of the Sun's

photosphere is depicted on Mr. De La Rue's photographs, and the photographic and eye-observations are thus shown to be in accordance.

During the past year Mr. De La Rue's paper On the Total Solar Eclipse of 1860 has been published in the *Philosophical Transactions* of the Royal Society, and the applicability of astronomical photography to the obtaining of numerical data may be considered as having been therein clearly established.

Hartwell Observatory.

Little can be said respecting the proceedings at the Hartwell Observatory during the last year. Since the unexpected departure of Mr. Pogson, the regular work has been discontinued; but it is to be hoped that the Catalogue of Variable Stars commenced at Hartwell, and now in progress at Madras, will with time be completed.

Meanwhile, there is what may be termed a continuous task to be carried on at the Observatory by the Assistant, Mr. Samuel Horton, under the direction of Admiral Smyth,—namely, the examining and remeasuring of 145 Double Stars, selected from the Cycle of Celestial Objects.

Hopewell Observatory, Haddenham.

Mr. Dawes, owing to a combination of bad weather and bad health, has been able to make but few astronomical observations; but among them are some of especial interest. The transit of the shadow of the brightest satellite of *Saturn*, *Titan*, across the disk of the planet, has been observed; and to this may be added one observation of an eclipse of *Titan* itself in the planet's shadow. The former is a very rare phenomenon, and Mr. Dawes considers the latter to be unique. Sketches also have been made of the physical appearances of *Mars*, of Tuttle's Comet, and of certain solar spots.

It will be remembered that during the course of the present year, the late Captain Jacob, under the auspices of our Society, left England, with a telescope of adequate dimensions and of great excellence, for the purpose of observing some of the heavenly bodies at a highly favourable station in the Bombay Presidency. It is with very deep regret that the Council record the termination of this expedition and the disappointment of their well-founded hopes, caused by the untimely death of the able observer at the very moment of the commencement of his arduous work. The cost of the expedition has been defrayed partly from funds provided by the liberality of the British Government, and partly from the private resources of the lamented astronomer himself.

The Progress of Astronomy.

The Council are much gratified in being able to report that astronomical science during the past year has advanced with a steady and interesting progress. In the first place they invite the attention of the Society to the publication by Mr. De La Rue of a group of solar spots, printed in an ordinary press, from a metallic block, procured by the sole agencies of light and electricity, and untouched by any tool. This is the first instance of the application of Mr. Paul Pretsch's phototype process to the delineation of any celestial object. A second example of this important process has been given by Mr. De La Rue in his recently published Bakerian Lecture on the great Solar Eclipse of 1860. It is obvious that great will be the gain, if by the aid of this process, or by any other means, it shall ultimately become possible to multiply reliable copies of the delineations of celestial phenomena, from which have been eliminated uncontrollable errors, arising either from the imagination of the observer or from the imperfect art of the engraver.

But the successful application of photography has not been confined solely to the delineation of the physical features of celestial objects; in the hands of Mr. De La Rue it has vied in accuracy of measurement with the micrometer as ordinarily employed. As one instance of this out of many others, it may be mentioned, that at the middle of the totality of the great Solar Eclipse of 1860, the moon's diameter as obtained from the photograph was $1986''{\cdot}2$, while that inferred from calculation was $1986''{\cdot}1$.

In the next place Professor Bond's Monograph on Donati's Comet is entitled to especial commendation. Owing to the great pains, expense, and skill bestowed upon the numerous and elaborate engravings, this memoir can scarcely fail henceforth to raise the standard of excellence in astronomical illustration. A copy of Mr. Bond's work has been presented to the Society, and will probably be esteemed by the members as one of the most valuable presents of the year.

The hypothesis by which Bessel first attempted to explain the cause of the irregularities in the Proper Motions of *Sirius* and *Procyon* has received confirmation in an important degree from the recent researches of Mr. Safford of Harvard College and Mr. Auwers of Königsberg. It now appears established as an astronomical fact, that the heretofore anomalous motions of *Sirius* and *Procyon*, both in Right Ascension and in Declination, are explained and satisfied by the existence of invisible masses, round which these stars may be conceived to revolve, *Sirius* in fifty, and *Procyon* in forty years. The nature and amount of the substantial advance thus made in a most interesting but difficult branch of stellar astronomy, may be appreciated from the following philosophical remarks of Pro-

fessor Bond, to which both the Astronomer Royal and Sir John Herschel have added the expression of their general concurrence. "It is conceivable that the outstanding discrepancies from the hypothesis of a uniform motion in either Right Ascension or Declination, each series being taken by itself, might follow a systematic law which has yet nothing whatever to do with an actual change in the motion of the star, being merely an expression of the relations between errors of the determined places; and in fact Bessel's hypothesis of an invisible companion has always been open to suspicion on this ground. Now, however, the evidence excludes this suspicion, since it is in the highest degree improbable that the same law of error should hold for the discrepancies in Declination and for those in Right Ascension as well. All reasonable objection is thus removed, and the presence of an invisible mass in the neighbourhood of *Sirius*, comparable in magnitude with it, is entitled to be received as an established fact in astronomy."

In connexion with this subject it is worthy of remark that, as in the case of *Neptune*, the place of a visible celestial object was first indicated by the results of calculation; so, in the case of *Sirius* and *Procyon*, the presence of invisible masses is first felt through the agency of telescopic observation.

Among other subjects which demand our notice are two inequalities in the periodic time of Halley's Comet, discovered by M. Angström of Upsal; what is most observable in relation to this discovery is the fact of its having been deduced from data which were within the reach of all astronomers. An abstract of this short memoir appeared in our January number; a mere inspection of the plate appended to the original paper in the *Upsal Transactions*, will be sufficient for the appreciation of M. Angström's method, and of the conclusion which he derives from its application.

Practical astronomers will no doubt watch with interest the development of the properties of the new metallic alloy named Aluminium Bronze, under the hope that it may be found to possess some properties which render it a valuable substitute for gun-metal or brass in the construction of astronomical instruments. Colonel Strange has laid the results of his careful and able study of this compound so recently before the Society, that much further remark is here unnecessary. It may, however, be a matter of interest to add that in the framing of the large theodolites for the Indian Survey, Messrs. Simms have constructed some of the smaller portion with this alloy; with a laudable caution they await the results of further experience in the casting of this new substance, before they employ it to a more considerable extent.

The Society, and indeed all persons interested in the progress of physical science, will be glad to hear that the Astronomer Royal has completed an apparatus wherewith, in conjunction with the great Equatoreal at Greenwich, it is intended

to observe the dark lines in the spectra of stars. Some of these spectra have already been carefully observed and recorded by Donati; but owing to the brilliant speculations and remarkable experiments of Messrs. Kirschoff and Bunsen, there are at this moment so many questions of surpassing interest, connecting these lines with the nature of light in general, and with the physical constitution of the Sun in particular, that it is a matter for congratulation to know that the subject is also taken up by a philosopher so peculiarly competent for its investigation.

The Society will learn with much interest that Mr. De La Rue has enlarged some new photographs of the surface of the Moon in her various phases, to precisely the same scale as that adopted in Messrs. Beer and Mädler's map. It is needless to dilate on the peculiar value of such reliable delineations.

Glass mirrors of very considerable dimensions, and silvered by a chemical process, are now manufactured in Paris by Messrs. Secretan, and in Munich by Professor Steinheil, at a comparatively moderate cost. The advantages, however, which arise from the material employed, are to some extent counterbalanced by the necessity of a renewal of the silvering more frequently than a metallic speculum requires to be repolished.

Mr. Carrington has completed his Memoir containing observations during seven years and a half of the Solar Spots, and has taken preliminary steps for securing its publication. The amount of illustration indispensable to the subject has proved an impediment to its appearing in the *Transactions* of a Society whose issue is large; and it is probable that it will ultimately be undertaken by a publisher as an independent work on a subsidy of a certain amount being guaranteed. The Memoir consists of two parts, text and plates. The text contains, firstly, a preface describing fully the processes of observation and reduction, and the theory of certain small corrections not taken into account, and is followed by the auxiliary tables used at Redhill. The second section consists of a catalogue of all the nuclei which were selected as primary points of observation, arranged in columns, which need not be detailed on this occasion. The third section consists of a discussion of the deduced heliographical position of those nuclei in each group which, by aid of the diagrams, are identified as comparable on different days, and especially with the view of deducing the diurnal motions of the nuclei in both elements, which result from the use of very approximate elements of the rotation. In the next section these residual motions are assembled in a table arranged in order of the latitudes of the nuclei discussed, and the law which holds good in the mean is deduced with full evidence of the process pursued. The conclusion arrived at has already been stated to the Society at the Meeting in June last. The fifth section treats of the corrections of the assumed position of the solar equator, the theory and data being fully given. The re-

mainder of the text need not be particularly described. The plates are about 170 in number; two containing the figures necessary for explaining the method of observation and reduction; then ninety-nine plates, each showing the groups recorded during one whole rotation; then three, in which the distribution in latitude is rendered self-evident by compression; and, lastly, a series of plates necessary to supplement the rotation-plates, on which one aspect of a group can alone be shown. On these latter every appearance of a group is given, ranged in a series of squares from the top to the bottom of the plate, and thus the record is rendered complete, condensed as far as possible, and immediately instructive to the eye. No disks are given. During the past summer, Dr. Sabler, of Wilna, visited this country, to inform himself of the process of photographic registration organised by Mr. De La Rue, and was willingly allowed to copy the tables and extract all such portions of the last-mentioned Memoir, which he desired to have for use at the Observatory which the Russian Government has devoted to this branch of astronomy.

Some addition has been made to our more accurate acquaintance with the Moon's surface by the zealous and minute observations of Mr. Birt, who, during several years, has devoted much of his attention to this branch of astronomy. Mr. Birt is now examining the regions around *Plato*, under the hope of extending the discoveries made by Beer and Mädler.

Captain Shea continues with much perseverance to observe the number and position of such solar spots as are within the limits of vision of a small telescope. His delineation of the Sun's disk would be incomparably more valuable if they contained a fiducial line, or some definite co-ordinates of reference. Captain Shea's observations have now extended over a period of fifteen years, and four volumes of the results have been presented to the Society.

Planet Mars.

The planet *Mars*, during the last opposition, has been closely scrutinized by several astronomers, with instruments well adapted to such observations. The general result of these observations tends to show that the principal details visible on the surface of the planet remain constant during a long series of years. The snow or ice regions in the vicinity of the poles, however, are found to undergo changes not attributable to the effects of perspective arising from the changed position of *Mars'* axis in relation to the observer. Our energetic member, Mr. Lockyer, has succeeded in making a series of beautiful drawings of *Mars*, as seen in his 6-inch refractor, by Cook. Professor Phillips, of Oxford, has also made a

similar series, with the aid of an instrument of the same dimensions; and Father Secchi, of Rome, has also produced a very extensive series, so that materials now exist for the production of a very accurate globe of this planet.

Minor Planets.

Since the last Anniversary the number of Minor Planets has been increased from seventy-one to seventy-seven. In the middle of February it was announced by Professor Bond, that Mr. Safford, upon discussing a series of observations by Dr. Peters, presumed to belong to *Maia*, had found that only three of them could be reconciled with the observations of that planet at Cambridge, U.S., and had shown Dr. Peters' observations to apply to a previously unknown member of this group: it has since received the name *Feronia*. The *seventy-third* minor planet was detected by Mr. Tuttle, at Harvard College Observatory, U.S., on April 7, and has been named *Clytie;* the *seventy-fourth*, called *Galatea* on the proposition of Professor Littröw, was discovered by Mr. Tempel, at Marseilles, on August 29; the *seventy-fifth* by Dr. Peters, at the observatory of Hamilton College, N.Y., on September 22, and is yet unnamed; the *seventy-sixth* by Professor d'Arrest, at Copenhagen, on October 21, for which he has proposed the name *Freia;* and the *seventy-seventh* by Dr. Peters, on Nov. 12. A planet was detected by Dr. Luther, at the Observatory of Bilk, near Dusseldorf, on August 31, and has since proved to be *Daphne*, which had not been found at several previous oppositions, and indeed may be said to have been nearly lost.

Comets.

The Cometary discoveries of the year are *four* in number; the *first* Comet was found by Mr. Schmidt, at the Observatory of Athens on the evening of July 2, and two hours later by Mr. Tempel, at Marseilles; a parabola suffices for the representation of the observations. The *second* appears to have been seen at Marathon, U. S., by an amateur astronomer, Mr. Swift, as early as July 15; three days afterwards it was found by Mr. Tuttle, at Harvard College, Massachusetts, and on the 22d was perceived at the Observatory of the Museum at Florence, by Mr. Toussant: other independent European discoveries have been recorded. This Comet was for some time a conspicuous object to the naked eye, and exhibited many interesting physical phenomena. It was observed in Europe till near the end of September. Observations taken by Mr. Tebbutt and others in Australia have also been published. The orbit is certainly elliptical, and, according to

a careful discussion by Mr. Oppolzer of the Vienna Observatory, it would appear that the time of revolution is about 142 years. Computations by other astronomers sufficiently confirm this result. The *third* Comet was detected, on the morning of November 28, by Professor Respighi, at Bologna, and three days later by Dr. Bruhns, at Leipsic. It is still within reach of powerful instruments. The orbit does not sensibly differ from a parabola, so far as can be judged from calculations up to this time. The *fourth* Comet, discovered by Dr. Bruhns on the morning of December 2, was not observed in Europe after the middle of the month, on account of its rapid motion towards the south. A fortnight's observations are well satisfied by a parabolic orbit.

The short-period Comet of Brorsen has passed its perihelion unobserved, chiefly owing, no doubt, to its unfavourable position in the morning twilight.

The Council in their Report of the astronomical proceedings of the year cannot but advert to the recent perilous balloon ascents of their colleague, Mr. Glaisher, to heights above the earth's surface heretofore unreached. One of the main objects of these ascents was to extend and improve our knowledge of the relation which exist between increase of elevation and the corresponding variations of temperature and moisture, these variations in their turn having an intimate bearing on the theoretic determination of atmospheric refraction.

The results of Mr. Glaisher's observations indicate that the hypothesis of a diminution of 1° Fahr. of temperature for every additional 300 feet of elevation must be abandoned, even for inconsiderable heights above the earth's surface. The variation of temperature for the same variation of altitude is found also greatly to depend on the clearness or cloudiness of the sky. Thus, through the first 1000 feet, under a cloudy sky there is a change of 1° Fahr. for every 213 feet, but if the sky be clear there is a diminution of 1° Fahr. for every 139 feet. At extreme heights, such as between 25,000 and 30,000 feet, it requires a full 1000 feet of additional altitude to cause a diminution of temperature of 1° Fahr.

In conclusion, the Council have to report that among the subjects which have engaged their attention during the year, the promotion of the Survey of the Southern Hemisphere, on the plan of Dr. Argelander, has had special consideration. A committee, consisting of the Astronomer Royal, Mr. Hind, and Mr. Carrington, was appointed to confer on the subject, and finally handed in the following report at the first meeting of this year, which the Council have unanimously adopted, and ordered to be printed as part of the Annual Report of this day.

"1. The proposal which was submitted to the Council in the month of June was principally based on the expressed wish of Dr. Argelander that a Survey of the Southern Hemisphere of Stars should be undertaken by British means on a similar scale to that which he had in hand at Bonn; and the proposition has been renewed, of late years, frequently in his private correspondence, as he was approaching the termination of his undertaking. The Committee fully agree with his feeling that it is highly desirable, for the progress of Astronomy, that such a Survey of the Southern half of the Heavens should be made, and that the ideal of the two halves of the Survey, being contemporaneous, should not be departed from more than may be unavoidable. The Committee believe that the promotion of undertakings such as the present lies fully within the scope of action of the Society, as defined by its By-laws; and they think that the Council may usefully take into consideration, at the present time, whether advantage may be taken of one of the stations which the country possesses in the Southern Hemisphere — as at the Cape of Good Hope, Sydney, Williamstown, Melbourne, or Hobarton.

"2. The work involved in the proposed Survey is of very simple character, but of considerable extent. The number of stars to be observed may be estimated at about 300,000, each to be twice recorded, without reckoning the revision of imperfect zones, and searches for the purpose of removing doubtful cases. By the employment of four persons simultaneously, the work of observation, reduction, formation of standard catalogue, collation with previous authorities, and formation of maps, would, as for the Northern half, under equally efficient superintendence, necessarily require the labour of from six to eight years — an estimate which, admitting of little correction, forbids the entertainment of the supposition that there is any probability of the task being at any time executed by private enterprise. The work is essentially one which must be performed by the staff of an official observatory, or by some special addition to the fixed staff of an establishment; and this being the case, the support of a body such as the Royal Astronomical Society, and the assistance of external funds, appear the only available means of carrying out a work of the kind contemplated.

"3. Should the Council take this view of the matter, the Committee are prepared to state that the requirements, as respects instrumental means, are so small as to constitute no difficulty whatever. The selection of an Astronomer to whom the superintendence of the undertaking could confidently be intrusted is felt by the Committee to be the first position to be secured, in order to ensure success; but they are not as yet empowered to make any recommendation in this respect.

Further than this no difficulty is foreseen with respect to suitable assistants in the execution of the work, inasmuch as the details call for nothing beyond intelligence, method, and the degree of zeal which may be expected to come of itself to a task so directly competitive with a similar undertaking. Many young men may with ease be found who would readily and efficiently take their part in such a work, for such inducement of pay and position as would ordinarily be offered in such a case; and though the annual amount of salaries would be larger than the Society has hitherto applied to Government to provide at their suggestion, the total is but little in comparison with what has been granted in past years for other scientific purposes. There is the great advantage, in this instance, that the work is perfectly defined by the parallel Survey in the North, and that the return for the outlay may be regarded as certain beforehand.

"4. Lastly, the Committee have to mention that the Director of the Madras Observatory has notified his intention of executing a portion of this work forthwith at his station, which, apart from the accidents of life and health in an unhealthy place, may be expected to somewhat reduce the extent of the area to be surveyed independently of him. But it will be borne in mind that Madras is 13° N. of the Equator, and that this notice from Mr. Pogson can at most slightly modify the general proposal before the Council.

"5. The Committee have agreed to report thus generally, in the first instance, on the state of the case, and on the questions involved in the proposal which might otherwise be thought to entail difficulties with which it is in fact not surrounded, and abstain from making special recommendations till the inclination of the Council to move in the matter has been ascertained."

The Council, which this day retires, have thus endeavoured by preliminary inquiry to clear the ground for action in this matter on the part of their successors in office, to whom they commend the further promotion of the undertaking.

Papers read before the Society from February 1862 *to February* 1863.

1862.

Mar. 14. Discovery and Observations of Comet III. 1861. Mr. Bond.

On the Perturbations of *Uranus* and Mass of *Jupiter*. Mr. Safford.

On the Proper Motion of *Sirius* in Declination. Mr. Safford.

Moon Culminators, Greenwich, Sydney, and Cape of Good Hope. Mr. Scott.
Observations of Comet II. 1861. Mr. Mackay.
On the Irregularity of the Proper Motion of *Sirius*. M. Auwers.
Observations at Malta: Discovery of New Star in Trapezium of *Orion*. Mr. Lassell.
Transit of *Mercury*, &c. Mr. Abbott.
Ephemeris of Long-Period Variable Stars for 1862. Mr. Pogson.
On some Variable Stars. Mr. Knott.
Observations of Transit of *Mercury* and Solar Eclipse. M. Bulard.
On Astronomical Refraction. Mr. Yates.
Occultation observed at Highbury. Mr. Burr.
Orbit of ξ *Ursæ Majoris*. Mr. Breen.
Observations of Solar Eclipse, Dec. 31, 1861. M. D'Arcy.

Apr. 12. On Solar Spots. M. Jeanjaquet.
Rediscovery of *Alhazen*, a supposed Lunar Crater. Mr. Birt.
Opposition of *Mars*, &c. Lieut. Gilliss.
Observations of Encke's Comet. Mr. Hartnup.
On the Disappearance of a Nebula in *Coma Berenices*. Sir J. Herschel.
Note of a Circular Dark Spot on the Sun's Disk. Mr. Lummis.
Transit of *Mercury*. Mr. Abbott.

May 9. Observation of a Meteor, April 14, 1862. Mr. Gorton.
Transit of the Shadow of *Titan* across the Disk of *Saturn*. Rev. W. R. Dawes.
On Heliotypography. Mr. De La Rue.
On Hind's Nebula in *Taurus*. M. O. Struve.
Results of Meridional Observations of Small Planets, March 1862. Mr. Airy.
On the Asteroid *Feronia*. Dr. Peters.
Observations at Cambridge of Comet II. 1861. Mr. Adams.
Extract of Letter to Mr. Carrington on the Intra-Mercurial Planet. Mr. Littrow.
Extract of Letter to the Astronomer Royal on the Transit of *Mercury*. Mr. Todd.
On Encke's Comet: Extract of Letter to the Astronomer Royal. Sir T. Maclear.
On Lambert's Theorem for Elliptic Motion. Mr. Cayley.
On a Solar Spot and on a Transit of *Titan* over *Saturn*. Mr. Gorton.
Observation of the Appearance of the Ansæ of *Saturn*. Mr. Carpenter.

On the Variable Star U *Geminorum*. Mr. Baxendell.
Transit of the Shadow of *Titan*. Mr. Lockyer.
Observations of Comet I. 1861. Sir T. Maclear.
Announcement of New Instrument for Indian Trigonometrical Survey. Col. Strange.

June 13. Results of Meridional Observations of Small Planets. Mr. Airy.
On the Appearance of *Saturn's* Ring. Mr. Birt.
On the Solar Energy in the Autumn of 1861 and Spring of 1862. Mr. Birt.
Occultation: Disappearance of *Jupiter's* 1st Satellite. Mr. Talmage.
Extract of Letter from Dr. Winnecke. Rev. R. Main.
Disappearance of B.A.C. 4923 at the Moon's Dark Limb, 1862, June 9. Rev. R. Main.
Letter to the Astronomer Royal. M. Hoeck.
Extract of Letter to the Astronomer Royal. Mr. Scott.
On the Missing Nebula in *Coma Berenices*. M. Chacornac.
On some Phenomena attending the Disappearance of *Saturn's* Ring, May 19, 1862. Mr. Huggins.
On the Periodical Changes in the Belts and Surface of *Jupiter*. Mr. Huggins.
Saturnian Phenomena. Rev. W. R. Dawes.
On the Appearance of *Jupiter* without a Visible Satellite, Sept. 1843. Rev. W. R. Dawes.
On the Proposed Parallax. Observations of *Mars*, 1862. Prof. Smyth.
On the Solution of Kepler's Problem. M. De Gasparis.
Description of a New Aplanatic Eye-piece for Telescopes. Mr. Burr.
On the Mean Places of certain Fixed Stars. M. C. Rümker.
On a Solar Spot. Mr. Hodgson.

Nov. 14. On the Cluster κ *Crucis*. Mr. Abbott.
Observations of the Horizontal Refraction of the Sun. Major Lang.
On the Irregularities of the Motion of *Procyon*. Mr. Lynn.
On the Practicability of Observing the Occultation of Stars by the Moon at Sea. Mr. Smith.
Extract of a Letter from Dr. Wolfers. Rev. R. Main.
Measures of the Planet *Mars*. Rev. R. Main.
Observations of Comet II. 1862. Mr. Knott.
Ditto ditto Mr. Hartnup.
Ditto ditto Mr. Chalmers.
Ditto ditto Lieut. Chimmo.
Observations of a Comet. Mr. Abbott.
On the Extraordinary Brightness of the Lunar Spot *Aristarchus*. Dr. Stothardt.

On a Remarkable Chain of Lunar Craters. Mr. Birt.
On a New Method of obtaining the Value of the Divisions of a Transit Level. Capt. Noble.
On Combining the Angles of Regular Polyhædrons. Mr. Drach.
On Excentric and Centric Force. Mr. Pratt.
On the Identity of the Triple Star H. I. 13. Rev. W. R. Dawes.
Second Series of Observations of Double Stars at Madras. Mr. Powell.
On the Motion of a Pendulum with especial reference to the Foucaultian Experiment. Mr. Wackerbarth.
On Aluminium Bronze. Col. Strange.
Telescopic Appearance of *Mars*. Mr. Grove.
Letter to Mr. De La Rue on the True Figure and Dimensions of the Earth. M. Von Gumpach.
Account of Observations with the Elchies Equatoreal. Prof. C. P. Smyth.
Observations of Comet II. 1862. Rev. R. Main.

Dec. 12. On the Variable Star R *Vulpeculæ*. Mr. Knott.
A last Letter from Capt. Jacob. Prof. C. P. Smyth.
Letter presenting Helioautographs. Rev. Prof. Selwyn.
Observations on *Saturn*. Mr. Wray.
A New and Close Approximation to the Circumference of the Circle, &c. Mr. Drach.
On the Gregorian Calendar. Mr. Drach.
Observations of a Comet. Mr. Cockburn.
On the Form of Lenses for Negative Eye-piece of Telescopes. Mr. Airy.
On the Great Solar Spot of August 4, 1862. Mr. Howlett.

1863.

Jan. 9. Extract of Letter to the Astronomer Royal. M. Auwers.
Letter, with Observations of *Saturn* made at Pulkowa and Greenwich. Mr. Airy.
Observations of *Mars*. Mr. Joynson.
Observations of a Comet in Australia. Mr. Tebbutt.
Observations of *Asia* (67). Mr. Hartnup.
Observations of Comet II. 1862. M. Romberg.
Results of Meridional Observations of Small Planets. Mr. Airy.
On the Observations made with the Elchies Equatoreal. Rev. W. R. Dawes.
Elements and Ephemeris of *Feronia* (71). Dr. Peters.
On the Elchies Equatoreal. Mr. Knott.
Note on U *Geminorum*. Mr. Baxendell.

List of Public Institutions and of Persons who have contributed to the Society's Library, &c. since the last Anniversary.

Her Majesty's Government.
The Secretary of State for War.
The Secretary of State for India.
The Lords Commissioners of the Admiralty.
The Board of Trade.
The Postmaster General.
Royal Society of London.
Royal Asiatic Society.
Royal Geographical Society.
Royal Institution.
Royal United Service Institution.
Geological Society.
Linnean Society.
Zoological Society.
Photographic Society.
Society of Arts.
British Meteorological Society.
British Association.
Art-Union of London.
Institute of Actuaries.
British Horological Institute.
Radcliffe Trustees.
Syndicate of Cambridge Observatory.
Lancashire Historic Society.
Liverpool Mercantile Marine Association.
Literary and Philosophical Society at Manchester
Royal Society of Edinburgh.
Scottish Society of Arts.
Royal Irish Academy.
Royal Dublin Society.
Royal Society of Van Dieman's Land.
Imperial Observatory, Paris.
Imperial Observatory, Vienna.
Royal Observatory, Munich.
Royal Observatory, Brussels.
Royal Observatory, Madrid.
Observatory, San Fernando.
Observatory at Bonn.
L'Académie Impériale des Sciences de l'Institut de France.
Le Dépôt Général de la Marine.
Le Bureau des Longitudes.
L'Académie Impériale de Dijon.
The Society at Cherbourg.
Imperial Academy of Sciences, Vienna.
Royal Academy of Sciences, Berlin.

The Society of Physics, Berlin.
Royal Academy of Sciences, Munich.
Royal Academy of Sciences, Brussels.
Royal Academy of Sciences, Göttingen.
Royal Academy of Sciences, Amsterdam.
Royal Society, Naples.
Royal Swedish Academy.
Imperial Academy, St. Petersburg.
Hungarian Academy.
Academy of Sciences, Batavia.
Society at Berne.
Society at Upsala.
Society at Geneva.
Society at Leipsig.
Austrian Board of Marine.
Canadian Institute.
Government of the United States.
Committee of Harvard College.
Observatory of Harvard College.
American Academy of Arts and Sciences.
American Philosophical Society.
Smithsonian Institution.
Franklin Institute.
Committee of the American Coast Survey.
Boston (U.S.) Library Trustees.
Editors of Silliman's Journal.
Editor of the Athenæum.
Editor of the Literary Gazette.
Editor of the Parthenon.
Editor of the Critic.
Editor of the London Review.
Editor of the Reader.
Editor of the Intellectual Observer.
Editor of the Sculptor's Journal.

G. B. Airy, Esq.
M. Vallas Antal.
Prof. Argelander.
Prof. Armellini.
Dr. A. Bache.
F. C. Bakewell, Esq.
N. Beardmore, Esq.
Dr. Beke.
M. P. Béron.
A. W. Bennett, Esq.
W. R. Birt, Esq.
H. G. Bohn, Esq.
G. P. Bond, Esq.
J. A. Brown, Esq.
Dr. Bruhns.
Dr. Brunnow.
C. H. H. Cheyne, Esq.
E. H. Coleman, Esq.
Dr. H. L. D'Arrest.
Warren De la Rue, Esq.
Prof. De Morgan.
Dr. Donati.
S. M. Drach, Esq.
Rev. J. C. Ebden.
R. J. Ellery, Esq.
Prof. Encke.
M. C. Fearnley.
Prof. Q. Filopanti.
Adm. Fitzroy.
Dr. Francis.

M. le Prof. Gautier.
Comm. Gilliss.
J. Glaisher, Esq.
M. J. von Gumpach.
Dr. A. Hanggi.
M. Hankel.
Prof. Hansen.
J. Herapath, Esq.
J. R. Hux, Esq.
Mrs. Hannah Jackson.
J. Jopling, Esq.
Dr. Lee.
M. Mailly.
M. Mozzi Michaly.
M. J. H. Milberg.
M. L'Abbé Moigno.
M. C. Nagy.
H. A. Newton, Esq.
Dr. Oudemans.
Dr. Peters.
Prof. Plantamour.
Dr. Pratt.
M. Quetelet.
J. Reddie, Esq.
F. Rollaston, Esq.
Dr. J. Schönfeld.
W. Scott, Esq.
Prof. Secchi.
Rev. Prof. Selwyn.
S. Sharpe, Esq.
Capt. Shea.
M. Simler.
Messrs. Smith, Beck, and Beck.
Admiral Smyth.
John Stow, Esq.
Sig. R. Tocani.
C. Todd, Esq.
Capt. H. Toynbee.
C. A. Twining, Esq.
G. V. Vernon, Esq.
C. Vignoles, Esq.
M. J. Villarceau.
J. J. Waterston, Esq.
G. Whiting, Esq.
Messrs. Willis and Sotheran.
M. Winnecke.
Dr. R. Wolf.
H. Worms, Esq.
J. Yates, Esq.
Dr. A. Ziegler.

Address delivered by the President, Dr. Lee, on presenting the Gold Medal of the Society to M. Argelander.

Gentlemen,—The established custom of this Society enjoins me to undertake the important duty of addressing you on the termination of our year of office, and of resigning into your hands the trust which you confided to me. But my gratification on this occasion is mixed with regret, inasmuch as this is the last time that I shall have the honour of speaking officially to you as President of the Royal Astronomical Society. The first idea which now occurs to me, is that of requesting you to accept of my respectful and grateful thanks for the honour which you have conferred upon me in placing me in this chair,—an honour which will be the source of pleasing reflections during the remainder of my days; and, whilst feeling that only a zeal for your interests, and in a life-long desire to promote the advancement of our noble Science, I can pretend to vie with those eminent men who have preceded me in this Presidency.

The opportunities of great discoveries in the regions of space, or in the theory of the grand and simple laws which rule the motions of those vast bodies which decorate the heavens, have not entirely passed away. The times of Kepler and of Newton, of Lagrange and of Bradley, will not again return. Where they reaped the rich harvest of astronomical truths we can but glean. We must rest content with the investigation of what has been well termed, by Sir John Herschel, "Residual Phenomena."

The principal Observatories of Europe, and of Africa, and of Asia, and of America, are now engaged in the gradual accumulation of systematic observations, and in recording facts, which, hereafter reduced to order, will serve as bases of verification of the accepted theories of our time, or will themselves become the germs of new theories, or the elements of undiscovered laws among the Astronomers of future ages.

Within the comparatively short period of the existence of this Society, of which Sir William Herschel was the first President in 1820, and of which, two of the Council, and two of the three original Secretaries are still existing, and shining as stars of the first magnitude in their diverse regions of Science, and all of them being Members of the Royal Society, what a world of splendid incidents, bearing on its pursuits, have been revealed to skill and perseverance!

Such are, The improved knowledge of Cometary Motion; the investigation of the Nebular Theory; the repetition of the Cavendish Experiment; the "Resisting Medium" discussion; the taking of Transits by Galvanism; the Chronoscopic intercourse between Observatories; the Electric Telegraph, and its application to the longitudes of places; the Undulatory Movement of Light; the application of the new and surprising art of Photography to the Sun, the Moon, and even the double stars; the detected affinity between the Solar Spots and Terrestrial Magnetism; the orbits of Binary Stars; the lines of the Solar Spectrum; the triumphant winning of Neptune, and the finding of upwards of seventy Minor Planets between *Mars* and *Jupiter*.

Amongst those things deserving of record in the progress of celestial observations within the last two years, it would be unpardonable in me, were I to pass over in silence the dauntless excursions in the firmament undertaken by our indefatigable colleague, Mr. Glaisher, and his fearless companion, Mr. Coxwell. At one time much was expected to accrue to Meteorological Science from aeronautic expeditions; but I think it may be safely conceded, that from the days of Gay Lussac and Biot to our own, little has been done deserving of scientific record until the important discoveries which these two gentlemen have brought to our knowledge by their successful balloon ascents during the preceding year.

Such are the great and interesting results extracted from

the recesses of nature, by skill and perseverance, in the brief span of time to which I have alluded; and it is gratifying to recollect the practical aid which some of our Members have rendered towards the advancement of these invaluable branches of Science, as well as the Society's liberal recognition of all the labourers in this vineyard, whatever clime or country they pertained to. This is well exemplified by noting the awards to merit made from year to year by our successive Councils; and in this, as you are all aware, it has been a principle well understood and acted upon in the adjudications, that the mere official product of public establishments, however admirably executed, is not to be placed in competition with those spontaneous investigations which spring from the voluntary ardour of individual exertions, unless improved methods are introduced.

In illustration of this, I may remark that our exponents of high approbation of astronomical labours are seen in the bestowal of our honorary distinctions.

Since the founding of this Society in 1820, there have been forty-three medals awarded to merit, of which nineteen have been bestowed on foreigners, and twenty-four on our own countrymen, a very fair proof of the cosmopolite principles on which we have hitherto acted.

I now come to the subject which is the principal object of this Address, namely, the Council's award of the Gold Medal for this year to F. W. A. Argelander, the distinguished Professor of Astronomy at the University of Bonn, in Prussia, —a gentleman whose high claims will occur to you all, on a recollection of his able superintendence of the several observatories of Abo, Helsingfors, and Bonn, the various works which he has published, and the numerous communications which he has made to the scientific public in Baron de Zach's *Correspondance Astronomique*, and the *Astronomische Nachrichten*. The Observatory of Bonn was founded by the laudable and intelligent spirit of the Kingdom of Prussia, and the whole of the expenses of the establishment are supported by the well-bestowed liberality of that country.

A large portion of the Professor's researches has been devoted to that crucial element, the Proper Motions of the Stars. The general method of ascertaining these has been by comparing two sidereal Catalogues with a considerable interval between their epochs, thereby to detect any difference which does not correspond with the amount of the precession of the equinoxes; yet, as the earlier catalogue is more liable to the consequences of instrumental errors than the more delicate observations of recent days, the real truth can only be extracted from repeated operations and improved methods. Numbers of supposed erratic bodies are cleared off the working list at each succeeding course of investigation; but those which are thereby confirmed and proved, become of the gravest importance for

all future investigations of the Stellar Laws. To this problem Argelander applied his experience and skill with such success, that in the year 1835 he published his well-known Catalogue of 560 Stars, with their motions as determined by his observations in Finland. Under this examination he assumed, that of the 560 stars, 390 of them had proper motions exceeding 0″·1 per annum; and from this he deduced a very interesting result relative to the movement of the Solar System towards a point in the heavens, presenting a near agreement with that which was roughly conjectured fifty-two years before, by our peerless extra-meridian Præses, the late Sir William Herschel.

By the refined investigation of the Abo results, the co-ordinates of the point in question, referred to the mean equinox of 1792, are

R.A. = 259° 47′·6 with a probable error of 3″·28
Dec. = + 32° 29′·5 do. 2″·20

The course of these studies led the Professor to estimate the comparative magnitudes of the stars by the unassisted eye, and he arrived at the conclusion, that in the space between the North Pole and 30 degrees of Southern Declination, there are 3256 stars visible to the naked eye.

Many faint stars had been included in former celestial charts, while brighter ones had been neglected. Argelander found about twenty stars which, though visible to the naked eye, were not contained in any trustworthy Catalogue. The importance of thus giving to future astronomers the means of judging whether any gradual and very slow changes are taking place in the relative magnitudes is sufficiently evident. He also watched assiduously for the changes attributed to those singular bodies, the Variable Stars. Hence followed his remarkable disquisition from his own personal observations, on the double maximum and minimum curve of *β Lyræ*, in 1843; a result which, though differing in particulars, confirmed the researches of our countryman (Goodricke) in 1784; to whom is due the discovery of the changes of brightness in *β Lyræ*. This memoir, perhaps, stimulated the attention of modern observers upon the strange phenomena which these stars exhibit. This course he has followed out with signal success; and in our *Monthly Notices* for June 1856, we have copied from the *Astronomische Nachrichten* his able suggestions respecting a "Method for determining the Brightness of the Minor Planets."

In the same *Notices* for December 1861 is a Report on the progress of the admirable Star-Charts in course of execution at Bonn. It is communicated by our indefatigable colleague, Mr. Carrington, who received it from Dr. Krüger, by the direction of Professor Argelander.

This is a singularly interesting Report. It describes the various parts of the magnificent Catalogue, which will embody

30,000 (accurately) determined stars. It is, therefore, well deserving of a reperusal by all our Members, as it explains lucidly what portions of the Stellar Zones are finished and fully published. Also, the part which was in the press, and what share remained in the press at that time, are duly detailed; and it must be a matter of gratification to an English reader, that the Catalogues of our Members,— Groombridge, Johnson, and Carrington,— have been closely consulted in the construction of this great product of science; and they are associated with the eminent foreigners, Lalande, Piazzi, Bessel, Struve, Schwerd, and Rümker.

The remark at the conclusion of this communication is deserving of our full attention, and, I think, approbation; namely, "That the Fellows of this Society, and all to whom "this account comes, cannot fail to admire the stately progress "of this enormous work, which, simple in its conception, and "free from insurmountable difficulties in execution, would "*appal* many an astronomer by its vast extent."

The Zone Observations of Dr. Argelander, contained in the first two volumes of his work, and made at Bonn, are of great importance. This extensive and valuable work may be looked upon as a continuation of Bessel's Zone Observations. These latter were limited by the parallels of 15° South and 45° North Declination. The Zones contained in Dr. Argelander's first volume extend from 45° to 80° of North Declination, and those in the second volume from 15° to 31° of South Declination. As in Bessel's Zones, the observations of each Zone are accompanied by an Auxiliary Table for reducing the apparent places of the stars observed, to the mean places for a given epoch. For the Zones in the first volume, the epoch chosen is the beginning of 1842, and for the second the beginning of 1850. The former Zones contain 26,424 separate observations, of which about 4000 are duplicate, so that the number of different stars contained in them is about 22,000. The latter, or Southern Zones, contain 23,250 observations, of which about 5600 are duplicate; so that the number of separate stars is about 17,600.

Thus we have a total of nearly 40,000 stars, whose places have been determined with very considerable accuracy, the probable error of a determination of Right Ascension corresponding to an equatoreal interval scarcely exceeding $0^s.1$, and that of a determination of Declination scarcely exceeding $1''$, except for some of the more Southern Zones.

Bessel's Zones comprise about 75,000 observations of nearly 62,000 different stars. Mr. Carrington's excellent Redhill Catalogue contains the places of nearly 4000 stars between the Pole and 81° of North Declination, the observations being made on a somewhat more extended plan than those of Bessel and Argelander.

Thus, by the junction of the labours of these three astronomers, the places of above 105,000 stars lying between the

North Pole and 31° of South Declination have been well determined. It would be highly desirable that Zone observations on a similar plan to that of Bessel and Argelander, should be undertaken by some zealous astronomer in the Southern Hemisphere, so that the survey might be extended to the South Pole.

Vast as is the number of stars whose places have thus been determined, it is far exceeded by the number recorded in Dr. Argelander's Survey of the Northern Heavens, which forms the basis of his beautiful new Star-Charts, and for which your Council have awarded him the Medal of the Society.

The first section of this work, forming the third volume of the *Bonn Observations*, contains the approximate places of 110,984 stars between 2° South and 20° North Declination. The second section, forming the fourth volume, contains the approximate places of 105,075 stars between 20° and 40° of north declination.

Dr. Argelander's plan of survey extends to the whole of the Northern heavens; but, in the hope that a similar survey may be undertaken in the Southern hemisphere, he includes the first two degrees of Southern declination, for the sake of affording means of comparison between the two works.

Within the above-mentioned limits the Charts were to contain all stars down to the 9th magnitude, as far as possible all the brighter ones of the 9-10 magnitude, and as many of the remainder of this class as circumstances permitted. The magnitudes were not to be more than a half-class in error, and the positions in both co-ordinates not more than one minute in error, so that every star in the Charts might be at once found again in meridian instruments; and that, with respect to neighbouring stars, no doubt should occur which was meant. All gross errors in existing Star-Catalogues were also to be noticed and corrected, whether they related to the magnitudes or positions of the stars.

As an instance of the utility of this work of Dr. Argelander, it may be mentioned that this survey immediately supplied proper stars to be compared with *Mars*, with the view of determining his parallax by equatoreal observations during the last autumn. Also, it enables us at once to identify stars that have been compared with planets and comets. Also, to detect and correct any errors of entire minutes, and such-like errors, which not unfrequently occur in recorded observations or in Catalogues.

It is said that Professor Challis has made great use of Dr. Argelander's last published Catalogue in identifying stars observed with the transit and mural circle of the Observatory of Cambridge, and in correcting or verifying the minutes of right ascension and north polar distance given by the observations. In cases of discordances between the results of observation and the places of a working catalogue of zodiacal stars,

founded on the British Association Catalogue, and those of Weisse and Lalande, he was generally able to determine on which side the error lay, by means of Argelander's Catalogue; and the large number of such instances afforded good evidence of its trustworthiness and accuracy.

Argelander began his Zones in the spring of 1852, and finished them in the spring of 1859.

The number of stars to be registered is, in all, about 310,000, as follows:—

0°	to	20°	105,000
20	to	40	93,000
40	to	60	69,000
60	to	80	37,000
80	to	90	5,000
			309,000

Such have been the laborious and persevering exertions of our experienced Associate to render the knowledge of our European skies as perfect as, humanly speaking, is possible by his admirable Zones in continuation of Bessel's, his beautiful Sidereal Charts, and his unequalled Survey of the heavens of the Northern Hemisphere, which comprises all the first nine magnitudes of the stars; and for which your Council have awarded Professor Argelander the highest honorary distinction which it is in their power to bestow.

My anticipation, therefore, is, that the Members will, by an unanimous vote, confirm this decision of their Council; which Council I can affirm, in all its consultations, has freely devoted the best of its judgment to this result. Indeed it has willingly employed its time to the promotion of the interests of science, and of your reputation, in all its operations during my occupation of this Chair.

The President then addressed the Foreign Secretary thus:—

Admiral Manners,—In transmitting this Medal to Professor Argelander, as an acknowledgment by this Society of his zeal, perseverance, ability, and industry, in sidereal investigation, be good enough, with your usual courtesy and kindness, also to convey to him, with our best wishes for his health and happiness, the deep interest which we have taken in his past, and which we must continue to take in his future, labours for the promotion of Astronomy.

The Meeting then proceeded to the election of the Officers and Council for the ensuing year, when the following Fellows were elected:—

President:

G. B. Airy, Esq. M.A. F.R.S. Astronomer Royal.

Vice-Presidents:

Arthur Cayley, Esq. M.A. F.R.S.
Warren De La Rue, Esq. F.R.S.
John Lee, Esq. LL.D. F.R.S.
Charles B. Vignoles, Esq. F.R.S.

Treasurer:

Samuel Charles Whitbread, Esq., F.R.S.

Secretaries:

Richard Hodgson, Esq.
Rev. C. Pritchard, M.A. F.R.S.

Foreign Secretary:

Admiral R. H. Manners.

Council:

Professor J. C. Adams, Esq. M.A. F.R.S.
Richard C. Carrington, Esq. F.R.S.
Richard Farley, Esq.
Rev. George Fisher, M.A. F.R.S.
Charles Frodsham, Esq.
James Glaisher, Esq. F.R.S.
John Russell Hind, Esq., Superintendent of the *Nautical Almanac.*
Rev. Robert Main, M.A. F.R.S. Radcliffe Observer.
Rev. Professor Selwyn, B.D.
Edward J. Stone, Esq. M.A.
Lieut.-Col. A. Strange.
Charles V. Walker, Esq. F.R.S.

Printed by Strangeways and Walden, Castle St. Leicester Sq., and Published at the Apartments of the Society, March 11, 1863.